Comparing the Long-term Fiscal Outlook for Canada and the United States Using Fiscal Gaps

Suzanne Kennedy and Chris Matier

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Abstract

The goal of this paper is to compare the long-term fiscal outlook in Canada and the United States using a simple measure of the sustainability of federal fiscal policy. The paper begins by explaining that standard Canada-US fiscal comparisons can be misleading because they do not take account of the very different treatment of public pension plans in the two countries. As an alternative to such comparisons, the paper presents a framework based on the "fiscal gap", which is the amount by which taxes must be increased, or program spending decreased, in order to ensure that the debt-to-GDP ratio will return to its current level by a given point in the future. Using this framework, the paper presents a comparison of fiscal prospects in Canada and the US over three time frames: through 2025, 2050 and 2075. We find a sharp contrast between the estimated Canadian and US fiscal gaps over all three time horizons. The US fiscal gap estimates, based on projections made by the US General Accounting Office, indicate that current federal fiscal policy in the US is unsustainable over the long term, necessitating future tax hikes and/or cuts in program spending in order to control the debt-to-GDP ratio. By contrast, we find that the finances of comparable sectors in Canada – the federal government and the CPP/QPP – are sustainable over the long term.

Résumé

Ce document a pour but de comparer les perspectives budgétaires à long terme du Canada et des États-Unis à l'aide d'une mesure simple de la soutenabilité de la politique budgétaire fédérale. Le document explique d'abord que les comparaisons budgétaires courantes entre le Canada et les États-Unis sont trompeuses parce qu'elles ne tiennent pas compte du traitement très différent réservé dans les deux pays aux régimes de retraite universels. Comme solution de rechange à ces comparaisons, le document présente un cadre fondé sur l'« écart fiscal », soit le montant de l'augmentation nécessaire des impôts ou de la diminution nécessaire des dépenses de programmes pour assurer que le ratio de la dette au PIB reviendra à son niveau actuel sur une période donnée. Grâce à ce cadre, le document présente une comparaison des perspectives budgétaires du Canada et des États-Unis selon trois échéanciers : jusqu'en 2025, 2050 et 2075. Nous observons un fort contraste entre les écarts fiscaux estimatifs au Canada et aux États-Unis sur ces trois horizons prévisionnels. Les estimations de l'écart fiscal aux États-Unis, selon des projections réalisées par le General Accounting Office, indiquent que la politique budgétaire fédérale actuelle aux États-Unis est insoutenable à long terme, ce qui nécessitera des augmentations d'impôt ou des réductions des dépenses de programmes pour contrôler le ratio de la dette au PIB. Par contre, nous constatons que les finances des secteurs comparables au Canada – le gouvernement fédéral et le RPC/RRQ – sont soutenables à long terme.

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1. Introduction

The US federal fiscal situation is commonly used as a benchmark against which Canadian federal finances are compared. Unfortunately, such comparisons are often misleading because they are not conducted on a consistent basis. The goal of this paper is to compare fiscal prospects in Canada and the US using a simple measure of the sustainability of federal finances in the two countries. This measure is based on the "fiscal gap", the amount by which taxes must be increased, or program spending decreased, in order to achieve long-term fiscal balance.

The paper begins with an explanation of the factors that must be taken into account when comparing fiscal indicators of the two countries. Next, section 3 defines the fiscal gap and describes the analytical framework used in this paper to compare the two countries' finances on a consistent basis. Section 4 presents estimates of the US fiscal gap and section 5 presents the projections on which the Canadian fiscal gap estimates are based. Section 6 compares fiscal gap estimates for the two countries and interprets the results, and section 7 concludes.

2. Comparisons of federal finances: background on public pension systems in Canada and the US

Comparisons of federal finances in Canada and the US are usually based on cash measures, since these are the main fiscal indicators used in the US (i.e., the Canadian financial requirements and market debt are compared with the unified budget balance and debt held by the public in the US). On this basis, Canadian federal debt has been criticized as being too high relative to that of the US, especially when the US administration was proposing to eliminate debt held by the public within the next decade. In 2000-01, Canadian federal market debt stood at 42.3 per cent of GDP, nearly 10 percentage points higher than the US ratio of 32.7 per cent.

However, such comparisons are distorted by the status of the public pension plans in the two countries. The US fiscal balance includes the surpluses of its public pension plan, Social Security. As such, the surpluses can be used to reduce the government's market debt. However, technically, these surpluses are invested in Treasury bonds, which will eventually need to be redeemed in order to fund future pension benefits. This liability is not reflected in the market debt figure. In other words, the US government is accumulating an internal liability toward the Social Security accounts that is not reflected in simple comparisons of market debt.

By contrast, the Canada Pension Plan (CPP) is not part of the Canadian federal sector, and therefore the CPP surpluses are not included in the federal fiscal balance and cannot be used to reduce federal market debt. Because the US figures reflect the accumulated surpluses of the Social Security system but not the associated liabilities, comparisons of the two countries based on market debt give a distorted view of long-term fiscal prospects that is biased against Canada. Since pensions are such an important part of government finances going forward, a fair comparison should include the pension plans in both countries.

However, simply including the pension plans in both countries does not allow for a complete comparison of the two countries' financial well-being either, since it compares the pension plans' assets but not their liabilities. Although the US Social Security system currently generates large surpluses, it is expected to start running cash deficits beginning in 2017, at which point the Social Security system will need to begin redeeming its Treasury bonds in order to fund benefit payments. The federal government will then need to find the resources to finance the redemption of these bonds.

By contrast, the CPP is on sound financial footing, as premiums have already been raised in order to ensure sustainability. As part of a major reform of the system in 1996, the CPP was changed from a pay-as-you-go plan to one which is funded on a steady-state basis. In other words, contribution rates were increased until they reached a sustainable level, where they may be kept constant while ensuring that the plan has sufficient funding to deal with an ageing population. As such, the combined employer-employee contribution rate was raised from 5.6 per cent of pensionable earnings in 1996 to the steady-state level of 9.9 per cent in 2003. In addition, CPP surpluses are now invested in private sector assets. Thus, the ideal comparison of the fiscal health of both governments would not only include the pension plans of both countries, but would also take a longer-term perspective in order to measure the current build-up in surpluses against the accruing pension liabilities.

3. Analytical framework: the fiscal gap

Fortunately, there is a simple measure that can take all of these issues into account and summarize them in one single indicator: the fiscal gap, a measure that has been popularized by Auerbach in assessing fiscal sustainability in the US.[1]

3.1 Derivation of the fiscal gap

The fiscal gap is based on the government's intertemporal budget constraint and measures the gap between current fiscal policy and "sustainable" fiscal policy. Current fiscal policy is given by a projection of the government's primary balance (revenues minus program spending) based on an extrapolation of the existing fiscal structure. Sustainable fiscal policy is defined over a given time period by imposing some restriction on debt in the final period. In this paper, sustainability is defined as requiring that the debt-to-GDP ratio in the final period return to its initial level, consistent with Blanchard et al. (1990) and Auerbach (1994).[2]

First, the government's debt accumulation equation (1) is solved forward to the final period $t+T$, as in equation (2), which simply shows how government debt accumulates up to that period.

(1) $$D_t = (1+r)\cdot D_{t-1} - PB_t$$

[1] The fiscal gap methodology was developed in Blanchard et al. (1990) and Auerbach (1994).

[2] Alternatively, sustainability could be defined as achieving zero debt or any given stable debt ratio.

$$(2) \qquad D_t = (1+r)^{-T} D_{t+T} + \sum_{i=1}^{T} (1+r)^{-i} PB_{t+i}$$

Next, we require that the debt-to-GDP ratio in the final period must equal the initial debt-to-GDP ratio, as shown in equation (3).

$$(3) \qquad D_t = (1+r)^{-T} (D_t / GDP_t) \cdot GDP_{t+T} + \sum_{i=1}^{T} (1+r)^{-i} PB_{t+i}$$

Of course, it is unlikely that any given projection of the primary balance will satisfy the constraint in equation (3) exactly; some change in the primary balance will be needed to ensure that fiscal policy is sustainable. For convenience, this change can be expressed as a constant fraction of GDP, denoted by Δ in equations (4) and (5), which is called the fiscal gap.

$$(4) \qquad D_t = (1+r)^{-T} (D_t / GDP_t) \cdot GDP_{t+T} + \sum_{i=1}^{T} (1+r)^{-i} (\overline{PB}_{t+i} + \Delta \cdot GDP_{t+i})$$

$$(5) \qquad \Delta = \frac{D_t - \sum_{i=1}^{T} (1+r)^{-i} \overline{PB}_{t+i} - (1+r)^{-T} (D_t / GDP_t) \cdot GDP_{t+T}}{\sum_{i=1}^{T} (1+r)^{-i} GDP_{t+i}}$$

Specifically, for a given path of projected primary balances $\overline{PB}$ and an initial stock of debt, the fiscal gap is defined as the immediate change in the primary balance, expressed as a constant share of GDP, that is needed to satisfy the government's intertemporal budget constraint. In other words, the fiscal gap is the immediate increase in taxes and/or decrease in program spending, as a constant share of GDP, necessary to ensure that the debt-to-GDP ratio returns to its current level by the final period under consideration. A negative gap indicates that fiscal room is available, such that taxes may be decreased or program spending increased while still maintaining long-term balance.

3.2 Interpretation of the fiscal gap

It is important to be clear about what we can and cannot conclude from fiscal gap estimates. A fiscal gap of zero indicates that current fiscal policy is sustainable, in the sense that the debt-to-GDP ratio in the end period is projected to be equal to its current ratio without any corrective measures. However, this does not necessarily mean that that current fiscal policy is on an optimal path. For example, the fiscal gap could be equal to zero if the government is projected to run deficits every year, with the deficits growing at the same rate as GDP. Clearly, this may not be considered the optimal path for fiscal policy.

It is beyond the scope of this paper to define the optimal path for fiscal policy. As such, the fiscal gap estimates presented in the paper should not be interpreted as indicating

what governments should or should not do. Instead, they simply show whether current fiscal policy is sustainable based on the narrow definition of sustainability described in section 3.1. Positive fiscal gaps indicate that current fiscal policy is unsustainable given this definition of sustainability, while zero or negative fiscal gaps indicate that current policy settings are sustainable. Although this definition of sustainability is open to debate, we have chosen it based on conventions established in other work using fiscal gaps, as mentioned earlier.

Without defining the ideal level of a fiscal gap, we can nevertheless conclude that the more negative the fiscal gap, the better the long-run outlook for fiscal policy. As such, we place more emphasis in this paper on the fiscal gap estimates of Canada *relative to those of the US*, rather than on the point estimates themselves.

As a final clarification, a negative fiscal gap provides an estimate of the total value of measures that a government could adopt over a given time frame while ensuring that the debt-to-GDP ratio returns to its initial level, *which implies running deficits*. As such, a negative fiscal gap does not provide an estimate of surpluses that are immediately available to be devoted to measures.

3.3 Estimation of the fiscal gap

All that is needed to calculate the fiscal gap are projections of the future stream of primary balances and GDP. One of the main benefits of this indicator is that it is not necessary to use the same measures of debt or budget balance in both countries in order to produce comparable fiscal gap estimates. This enables us to compare fiscal gap estimates that are based on each country's main fiscal indicators, which by themselves are not strictly comparable, as discussed in section 2. What is most important in this type of analysis is that each country's framework be internally consistent. Similarly, it is not necessary for the projections to be based on the same economic assumptions; it is more important that each country's projections be based on reasonable assumptions for that country, which may be expected to differ across countries.

Moreover, differences in the initial debt level do not affect the comparability of the fiscal gap estimates. The fiscal gap provides an indicator of sustainability by measuring a country's initial debt burden against its projected future stream of primary balances. Thus, fiscal gap analysis allows us to make comparisons across countries with very different initial debt burdens, as in Blanchard et al. (1990). From equation (5) it can be shown that if one country has a higher initial debt burden than another country, it will be required to run higher primary balances than the low-debt country in order to achieve the same fiscal gap measure. In other words, countries with higher initial debt burdens are held to the same standard as countries with lower initial debt burdens, a feature that is particularly important for Canada-US comparisons.

Projections and related fiscal gap estimates for the US and Canada are described in the following sections. In both cases, the projections are not intended to provide forecasts of likely future fiscal outcomes. Instead, they are designed to illustrate the long-term impact of current fiscal policy. As with any long-term projection exercise, the assumptions

underlying these structural projections are subject to great uncertainty. Although these projections do not in any way provide a forecast of the future, they are nevertheless useful indicators. In testimony before the US Senate Budget Committee, the US Comptroller General recently discussed the usefulness and the proper use of these types of long-term projections (US GAO (2002)). As opposed to suggesting that Congress budget for a 20- or 30-year period, he recommended:

> ...considering establishing indicators and targets that bring a long-term perspective to budget deliberations and a process that prompts attention to the long-term implications of today's decisions... We would be the first to say that the simulations are not predictions of the future or point estimates, rather they serve as indicators – or warning lights – about the magnitude and direction of different policy profiles. These scenarios are particularly helpful in comparing long-term consequences of different fiscal paths or major reforms of entitlements using the same assumptions.

4. Estimates of the US fiscal gap

Much work has been published analyzing the long-term fiscal outlook in the US, including analyses by the administration's Office of Management and Budget, the Congressional Budget Office (CBO), Auerbach and other academics,[3] and the General Accounting Office (GAO). The Canada-US comparisons in this paper will be based on the work of GAO, because its economic projection framework is relatively simple and transparent, enabling us to use a similar framework for the Canadian projections.

In testimony before the US Senate Budget Committee, the US Comptroller General recently raised concerns about budgetary pressures related to population ageing that will emerge in less than ten years from now (US GAO (2002)). He warned that without structural changes in programs for the elderly, rising deficits and debt will overwhelm the US budget in the long term. Moreover, he stated that "because the longer-term outlook is driven in large part by known demographic trends, in some ways we can be surer about the outlook 20 years from now than the forecast for the next few years."

The Comptroller General's conclusions were based on GAO's January 2002 long-run budget simulations. GAO produced the simulations under two scenarios that are of interest for this comparison:

(1) In the first and most favourable scenario, the first ten years follow current law, including the expiry of the June 2001 tax cut package in 2010, and discretionary spending grows with inflation. After the first ten years, discretionary spending and revenues are held constant as a share of GDP and Social Security and Medicare are based on the actuaries' projections. All unified budget surpluses (i.e., including Social Security surpluses), which are projected to return in 2004, are assumed to be saved. Under this scenario, unified budget deficits return in 2036.

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[3] See, for example, Auerbach (1997), Auerbach and Gale (2000, 2001), and Auerbach, Gale and Orszag (2002).

(2) In the second scenario, discretionary spending is held constant as a share of GDP after 2002 and the June 2001 tax cut package is assumed to be permanent. As in the first scenario, tax revenues are held constant as a share of GDP after the first ten years. Under this scenario, unified deficits return in 2011.

Large and growing deficits emerge in both scenarios, even in the first where the tax cuts expire in 2010 and discretionary spending grows only with inflation. The imbalance is largely driven by growth in entitlement program spending. Under the second scenario, spending on net interest, Social Security, Medicare and Medicaid[4] rises to almost three-quarters of federal revenue by 2030 and exceeds federal revenue by 2050.

The second scenario is the most relevant scenario for the Canada-US comparisons in this paper. The first scenario is based on the assumption that the June 2001 tax cuts will expire in 2010, implying a dramatic rise in taxes in 2010 as tax rates revert to the levels that prevailed prior to the tax cut. Auerbach, Gale and Orszag (2002) argue that "virtually no one believes the tax provisions will sunset completely as stipulated [in the tax cut legislation]". In addition, the first scenario is based on the assumption that for the first ten years, discretionary spending in the US grows in line with inflation only, implying a decline in real per capita spending. Again, Auerbach, Gale and Orszag (2002) argue that a more reasonable interpretation of current policy would be to assume that discretionary spending is held constant on a real per capita basis, or to assume that discretionary spending grows with GDP. As described in section 5, the Canadian projections are based on the assumption that most program spending grows in line with either inflation plus population growth and an enrichment factor or with GDP. GAO's second scenario is more consistent with the Canadian projections in this respect, as it assumes that discretionary spending is held constant as a share of GDP after 2002. For these reasons, we judge that GAO's second scenario is the most appropriate interpretation of current US federal fiscal policy for the purpose of the Canada-US comparison in this paper, although it should be noted that the choice of scenarios does not affect our broad conclusions.

GAO's simulations are generally based on CBO's January 2002 economic and budget assumptions. Social Security and Medicare outlays are based on the 2001 Trustees' intermediate estimates. Once the Social Security and Medicare (Part A) trust funds have been exhausted, the model assumes general fund financing of all current law benefits in excess of program revenues. For Medicaid, the model uses CBO's January 2002 long-term projections.

The fiscal gap estimates associated with the simulations under both scenarios are shown in Table 1. The fiscal gap estimates through 2075 are positive under both scenarios,

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[4] Medicare provides health care for the elderly and disabled. It is divided into two parts: Hospital Insurance (Part A), which pays for inpatient hospital and related care and is funded mainly by payroll taxes; and Supplementary Medical Insurance (Part B), which pays for physician and outpatient services and receives about three-quarters of its income from transfers from general fund revenues, with the remainder from beneficiary premiums. Medicaid provides health care for low-income Americans. It is administered by the states and is funded jointly by the federal government and the states.

indicating that federal fiscal policy is unsustainable under both sets of assumptions. For example, in the second scenario, the estimated gap through 2075 is 4.1 per cent of GDP, meaning that an immediate and permanent increase in taxes or decrease in program spending equivalent to 4.1 per cent of GDP would be necessary to ensure that the debt-to-GDP ratio in 2075 would return to its current level. Moreover, the fiscal gap estimates for the second scenario are positive even over the shorter time horizons. In other words, even to ensure that the 2025 debt ratio returns to its current level, the federal government would need to take immediate corrective action.

Table 1
Estimates of fiscal gap* for US
(% of GDP)

	through 2025	through 2050	through 2075
(1) Baseline extended	-2.1	-0.3	1.0
(2) Discretionary spending grows with GDP, tax cuts do not sunset	0.2	2.5	4.1

* A positive gap indicates long-term imbalance; a negative gap indicates fiscal sustainability.
Source: US General Accounting Office, January 2002.

5. Canadian fiscal projections

This section describes the Canadian projections (federal, CPP/QPP (Canada and Quebec Pension Plans) and economic projections) used to produce fiscal gap estimates for Canada that are comparable with GAO's US fiscal gap estimates. As mentioned earlier, it is important to note that the projections are not forecasts of future fiscal outcomes. Instead, they are designed to illustrate the long-term impact of current fiscal policy by overlaying the existing fiscal structure onto a set of demographic projections. As with any long-term projection exercise, the assumptions underlying these structural projections are subject to great uncertainty.

5.1 Federal projections

In the federal sector, the primary balance is defined as revenue (net of revenue from financial assets) minus program spending. For the first four years, the federal spending projections are consistent with those in Budget 2001. From 2004-05 onwards, a structural projection framework is used,[5] where spending is derived by extrapolating from starting values for each category, X, such that real per capita-per age group values of the various categories grow in line with an exogenous enrichment factor, as shown in general terms in equation (6).

(6) $\quad X_{t+1} = (1+\text{demographic factor})^*(1+\text{inflation})^*(1+\text{enrichment})^*X_t$

[5] Based on the projection framework developed in King and Jackson (2000) and also used in Matier, Wu and Jackson (2001).

More specifically, in the base year, aggregate spending X_t is allocated across 91 single-year age groups indexed by i, ranging from age 0 to 90+ (yielding $X_{i,t}$ for i=1 to 91). Spending allocations by age group are obtained using Statistics Canada's Social Policy Database and Model (SPSD/M). The spending profiles are combined with population projections by age group, $POP_{i,t}$, based on Statistics Canada's medium growth scenario,[6] which provides projections out to 2026. The population projections are extended out to 2075 by assuming that fertility, life expectancy and immigration remain at their 2026 levels, and the labour force participation rate is assumed to remain constant. Along with a price index P, average real per capita spending by age group can thus be expressed as:

$$(7) \qquad A_{i,t} = \frac{X_{i,t}}{P_t \cdot POP_{i,t}}$$

Total spending on category X in the base year can therefore be expressed as the sum of the average spending on each age cohort multiplied by the total population of each age cohort and the price index:

$$(8) \qquad X_t = \sum_{i=1}^{91} A_{i,t} \cdot POP_{i,t} \cdot P_t$$

Incorporating the exogenous enrichment factor, the evolution of spending on category X can be expressed as:

$$(9) \qquad X_{t+1} = \left(\sum_{i=1}^{91} A_{i,t+1} \cdot POP_{i,t+1} \Big/ \sum_{i=1}^{91} A_{i,t} \cdot POP_{i,t} \right) \cdot (P_{t+1}/P_t) \cdot (1 + enrichment) \cdot X_t$$

The relative age profile of X, defined as $R_{i,t} \equiv A_{i,t}/A_{j,t}$ (where A_j is the numeraire age group), is held constant over the projection period (i.e., $R_{i,t} = R_i$). Assuming a constant rate of inflation, π, equation (9) becomes:

$$(10) \qquad X_{t+1} = \left(\sum_{i=1}^{91} R_i \cdot POP_{i,t+1} \Big/ \sum_{i=1}^{91} R_i \cdot POP_{i,t} \right) \cdot (1 + \pi) \cdot (1 + enrichment) \cdot X_t$$

The categories for which projections are made on this basis are elderly benefits (including Old Age Security pensions, the Guaranteed Income Supplement and the spouse's allowance) and Employment Insurance benefits. For these categories, the enrichment factor is set at 1.5 per cent[7] and inflation is assumed to be 2 per cent.

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[6] *Population Projections for Canada, Provinces and Territories, 2000-2026* (Catalogue no. 91-520)

[7] This enrichment factor slightly exceeds average growth in real per capita GDP (on an age-adjusted basis) over the period 1975-2001. It is also consistent with assumptions in other studies for Canada (see for example, Matier et al. (2001)).

Intergovernmental transfers are divided into three main categories: Fiscal Arrangements (FA), Alternative Payments for Standing Programs (APSP),[8] and the Canada Health and Social Transfer (CHST, a block transfer to the provinces to fund health and education spending). FA and APSP are assumed to remain constant as a share of GDP, and the CHST follows the First Ministers' Meeting funding agreement out to 2005-06, from which point it is assumed to grow at an annual rate of 3.5 per cent (the average annual rate of increase in CHST cash from 2001-02 to 2005-06). Other transfers are held constant as a share of GDP.

Direct program spending (i.e., all program spending not included in the categories mentioned above) is assumed to follow the Budget 2001 forecasts out to 2003-04, after which point it is assumed to remain constant as a share of GDP. This is consistent with the assumptions for discretionary spending in the main US projections used in this paper (GAO's second projection scenario).

Federal revenues are assumed to follow those laid out in Budget 2001 out to 2006-07, and are assumed to remain constant as a share of GDP thereafter, similar to GAO's US projections.

For the calculation of the present value of both the projected federal primary balances and GDP, the discount rate is assumed to be a constant 7 per cent. This corresponds roughly to the federal government's average effective net interest rate.

5.2 CPP/QPP projections

Official long-term projections for contributions and expenditures for the CPP (to 2100) and the QPP (to 2050) are provided in their actuarial reports. However, rather than incorporate these projections directly into our fiscal gap estimates, we used them to calibrate our own structural projections of CPP/QPP contributions and expenditures. This approach helps to reconcile differences in the economic and demographic assumptions used in the actuarial reports and our federal projections, thereby ensuring a degree of consistency within our framework.

In the CPP/QPP sector of our framework, the primary balance is defined as contributions less expenses (including benefit payments and administration costs). The CPP/QPP projections are based on the same structural equation described above and the same economic and demographic assumptions used for the federal spending projections. To ensure consistency with the CPP Chief Actuary's projections, the model was calibrated to approximate the Seventeenth Actuarial Report's projections for the CPP (as at December 31, 1997) under similar economic and demographic assumptions.[9]

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[8] FA consists mainly of Equalization and Territorial Formula Financing payments. APSP represents recoveries of federal tax-point abatements under contracting-out arrangements.

[9] The model was calibrated to the Seventeenth Actuarial Report, rather than the Eighteenth Actuarial Report, because its demographic assumptions were more consistent with the assumptions maintained in Statistics Canada's medium projection scenario, from which our population projections are taken.

Our calibration methodology is relatively straightforward. First, after accounting for differences in inflation, productivity and demographic assumptions, we derived an adjustment factor that reconciled our structural projection of the CPP primary balance and the Chief Actuary's projection. Next, this adjustment factor was incorporated into our combined CPP/QPP projections of contributions and expenditures in conjunction with the set of inflation, productivity and demographic assumptions used in our federal spending projections.

Figure 1[10] shows the actuarial projection and our structural model's projection of CPP expenditures out to 2075.[11] The simulation of expenditures produced by this simple projection model was, surprisingly, reasonably consistent with the actuarial projections. Simulated expenditures slightly exceeded the actuarial projections until shortly before 2060, then underestimated the actuarial projections. On the other hand, our simulated structural projection of contributions consistently fell short of the actuarial projections (Figure 2).[12]

Figure 1
CPP Expenditures
(% of GDP)

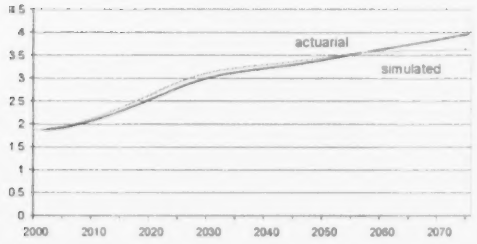
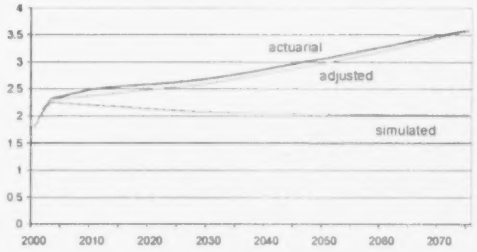


Figure 2
CPP Contributions
(% of GDP)



Since the simulated expenditure series tracked the actuarial projections reasonably well, and was not consistently under- or over-estimating, no adjustments were deemed necessary for this aspect of our structural model. However, our model was clearly underestimating contributions, necessitating some adjustment. In order to keep the model simple, only constant growth adjustment factors were considered.

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[10] Both figures show the simulated and actuarial projections as a percentage of the simulated GDP series.

[11] For the purpose of the calibration exercise, simulations were made for the period from 2000 to 2099. This time period was chosen in order to use the maximum amount of information available from the actuarial projections. In addition, the fiscal gap analysis is conducted over several time horizons, so there is no compelling reason to choose one of them in particular for the calibration.

[12] One reason for this discrepancy could be that the simple model does not include an adjustment for the labour force participation rate, as does the actuarial report. Since the participation rate of older cohorts is expected to increase over time, this would boost projected contributions. Of course, it would boost expenditures to some extent as well, but likely to a lesser degree.

Since the primary balance is the key element in the measure of sustainability used in this paper, the choice of the adjustment factor for contributions was made based on its effect on the simulated primary balance series. When applying a constant adjustment factor, the adjusted series generally underestimated the primary balance for part of the period, then overestimated relative to the actuarial projections. In order to balance the importance of accuracy in the early years of the projection period versus the later years, the adjustment factor was determined by choosing the factor whose associated fiscal gap estimate most closely matched the gap corresponding to the actuarial projections, without being more optimistic than the actuarial gap estimate. An adjustment factor of 0.77 per cent was chosen on that basis, yielding the "adjusted" series in Figure 2.

The adjustments derived from this calibration exercise were then used to produce the structural projections for the combined CPP/QPP, using the same inflation, enrichment and demographic assumptions underlying the federal spending projections. Specifically, contributions were projected as shown in equation (11).

(11) $X_{t+1} = (1+\text{demographic factor})^* (1+\text{inflation})^*(1+\text{enrichment})^*1.0077^*X_t$

For the calculation of the present value of projected CPP/QPP primary balances, the nominal interest rate is assumed to be 7 per cent, the same rate used in the calculation of the federal fiscal gap. Given that inflation is assumed to be 2 per cent, a discount rate of 7 per cent is consistent with a real rate of return on CPP/QPP assets of 5 per cent, which is in line with the average real rate of return on large private pension plans in Canada (Office of the Chief Actuary (1998)).[13]

5.3 Economic projections

The economic projections are based on the framework used by GAO and originally developed at the Federal Reserve Bank of New York.[14] The framework is a simple growth model where growth in GDP is determined by growth in the labour force, capital stock and total factor productivity. The model allows for interaction, or "feedback", between public sector saving and GDP via the savings channel: government saving impacts domestic saving, which in turn influences domestic investment, the capital stock, and ultimately GDP. GDP in turn influences government saving through its effect on federal revenues, as described above.

Of course, in order for government saving to have an impact on domestic saving, assumptions must be made regarding the degree of Ricardian equivalence. In our base case scenario, we assume that changes in private saving offset half of any change in government saving. Domestic savings then determine domestic investment, given certain assumptions about the degree of openness of the economy. Our base case scenario assumes that roughly two-thirds of any change in gross domestic saving flows abroad via

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[13] Note, however, that the actuarial report assumed a real rate of return of 4 per cent on new money invested in the CPP Fund.

[14] For example, see Harris and Steindel (1991).

a change in net foreign investment. Both assumptions seem reasonable based on historical Canadian experience. Further detail on the economic projection framework is provided in the appendix.

6. Canada-US comparison of fiscal gap estimates

6.1 Results and interpretation

Table 2 shows the resulting Canadian fiscal gap estimates, along with GAO's US fiscal gap estimates. The Canadian fiscal gap estimates are negative for the federal and CPP/QPP sectors (both individually and combined) over all three time horizons, indicating that current fiscal policy is sustainable in each case.[15] The relevant gap for the Canada-US comparison is the estimate for the federal and CPP/QPP sectors combined. This is comparable with the federal sector in the US, which includes Social Security.

There is a sharp contrast between the estimated Canadian fiscal gap and GAO's estimates of the US fiscal gap. Through 2075, the relevant Canadian fiscal gap estimate is -1.6 per cent of GDP, indicating sustainable fiscal policy. By contrast, the comparable GAO estimate suggests that the US has a positive fiscal gap of 4.1 per cent of GDP. In other words, the US federal government would need to raise taxes and/or cut program spending by an immediate and permanent 4.1 per cent of GDP in order to ensure that the debt ratio in 2075 returns to its current level. In practical terms, this is a significant imbalance. To put it into perspective, the tax cut package passed in the US in June 2001 provided tax relief of 0.7 per cent of GDP in 2002. The fiscal gap analysis suggests that taxes would need to be raised by more than five times the size of the June 2001 tax cuts in order to stabilize the debt ratio over a 75-year horizon. Moreover, the fiscal gap measures the *immediate* adjustment to fiscal policy needed to ensure long-term sustainability. If the change is not implemented immediately, the required adjustment grows even larger.

Even over a shorter time horizon, such as out to 2025, there is a major difference between the two countries. The Canadian gap through 2025 is -2.1 per cent of GDP, whereas the US estimates indicate a slight imbalance out to 2025.

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[15] The corresponding estimated fiscal gaps for the consolidated provincial/territorial sector are -1.1 per cent of GDP through 2025, -1.1 per cent through 2050 and -1.2 per cent through 2075, indicating sustainability over all three time horizons.

Table 2
Fiscal gap estimates*
(% of GDP)

United States (federal - includes Social Security)	through 2025	through 2050	through 2075
GAO scenario 1	-2.1	-0.3	1.0
GAO scenario 2 (main scenario for comparison)	**0.2**	**2.5**	**4.1**
Canada	**through 2025**	**through 2050**	**through 2075**
Federal and CPP/QPP	**-2.1**	**-1.6**	**-1.6**
of which:			
federal	-1.5	-1.3	-1.3
CPP/QPP	-0.6	-0.3	-0.3

* A positive gap indicates long-term imbalance; a negative gap indicates fiscal sustainability.

It is important to recall that the fiscal gap and the underlying projections are not intended to provide a forecast of future fiscal policy. Rather, the purpose is to show whether *current* fiscal policy is sustainable over the long term. Of course, we would expect that a government would take action to avoid allowing its debt-to-GDP ratio to explode. What this framework indicates is that the US will likely face very difficult decisions down the road, and that it will need to raise taxes by a significant amount and/or drastically cut spending in order to maintain control over its debt.

This is an important consideration for the fiscal policy debate within Canada, as the US is often used as a benchmark against which Canadian fiscal policy is measured. More often than not, Canada-US comparisons are focused on the short term and conclude that Canada's higher tax burden and debt burden relative to the US undermine Canada's competitiveness vis-à-vis its main trading partner. The evidence presented in this paper paints a very different picture. First, the US fiscal gap estimates indicate that the fiscal outlook for the US is unsustainable because of rising costs associated with the nation's ageing population. This in turn suggests that the recent round of tax cuts and market debt reduction in the US will not be sustainable. Moreover, the fiscal gap analysis demonstrates that when the broad picture is taken into account, Canada's long-term fiscal position is more favourable than that of the US.

As discussed in section 3.2, the negative fiscal gap estimate for Canada is not a measure of surpluses available for policy measures. All that it shows is the scale of measures that could be adopted while ensuring that the debt-to-GDP ratio in the final period equals the initial debt burden, which would imply running deficits. The estimate is based on an extrapolation of existing fiscal policy, not a forecast of future fiscal outcomes, and is subject to great uncertainty. Thus, the important point to take from this study is not the numerical value of the estimated Canadian fiscal gap, but rather its size in relation to the US estimate.

6.2 Sensitivity analysis

6.2.1 Sensitivity analysis of Canadian fiscal gap estimates

The sensitivity analysis summarized in Table 3 demonstrates that the Canadian fiscal gap estimates are robust to changes in the underlying economic or parameter assumptions. While changes in the assumptions do have an effect on the numerical value of the fiscal gap estimates, the scale of the impact is limited. More importantly, the sign of the combined federal-CPP/QPP gap remains negative under all scenarios.

At the same time, the sensitivity analysis demonstrates that we should not place too much importance on the exact numerical value of the fiscal gap. As mentioned earlier, the fiscal gap and the underlying projections are not intended to provide a forecast of future fiscal policy. Instead, they are designed to illustrate the long-term impact of *current* fiscal policy. Thus, they are based on a simple projection of current fiscal policy that precludes any additional policy action for the next 75 years.

While it is not necessary for the projections for Canada and the US to be based on the same economic assumptions in order to obtain fiscal gap estimates on a comparable basis, it is still interesting to compare some key economic assumptions underlying the two sets of projections. For the US, hours worked are projected to grow at an average annual rate of about 0.3 per cent from 2000 to 2075, which is similar to projected hours worked for Canada over the same period. Inflation is assumed to be 2 per cent in both countries. One important difference between the two sets of projections is total factor productivity (TFP) growth, which is assumed to be much higher in the US projections. After 2012, TFP growth is assumed to gradually increase to 1.6 per cent in the US. By contrast, TFP growth is assumed to be constant at 0.9 per cent in Canada. Table 3 explores the importance of this assumption in the Canadian case. As noted earlier, it is not necessary for the two countries' projections to be based on the same economic assumptions in order to make a meaningful comparison of fiscal gaps. More importantly, each country's projections should be based on economic assumptions that are reasonable for that country, and these may be expected to differ across countries.

All told, the sensitivity analysis shows that while we should not place too much emphasis on the exact numerical value of the gap, which may vary somewhat depending on the underlying assumptions, the overall message that Canada's federal and pension sectors are sustainable over the long run is robust to changes in the assumptions.[16] The following provides more detail on the sensitivity analysis.

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[16] While the gaps are calculated using the standard fiscal gap analysis definition of sustainability – that the debt-to-GDP ratio in the end period must return to its initial level – the qualitative conclusions about Canadian fiscal sustainability are not dependent on this definition.

Table 3
Sensitivity analysis of Canadian fiscal gap estimates

	through 2025	through 2050	through 2075
Base case			
Federal and CPP/QPP	-2.1	-1.6	-1.6
of which:			
federal	-1.5	-1.3	-1.3
CPP/QPP	-0.6	-0.3	-0.3
Higher interest rate: raised from 7% to 9%			
Federal and CPP/QPP	-1.2	-0.9	-0.9
of which:			
federal	-0.5	-0.3	-0.3
CPP/QPP	-0.7	-0.5	-0.5
Lower interest rate: lowered from 7% to 5%			
Federal and CPP/QPP	-2.9	-2.3	-2.2
of which:			
federal	-2.5	-2.1	-2.1
CPP/QPP	-0.4	-0.1	-0.1
Higher TFP growth: raised from 0.9% to 1.5%			
Federal and CPP/QPP	-2.6	-2.6	-3.0
of which:			
federal	-2.1	-2.4	-2.8
CPP/QPP	-0.5	-0.2	-0.2
Lower TFP growth: lowered from 0.9% to 0.3%			
Federal and CPP/QPP	-1.5	-0.5	-0.1
of which:			
federal	-0.9	-0.1	0.3
CPP/QPP	-0.6	-0.4	-0.4
Higher Ricardian offset: raised from 0.5 to 1.0			
Federal and CPP/QPP	-2.1	-1.5	-1.4
of which:			
federal	-1.5	-1.2	-1.1
CPP/QPP	-0.6	-0.3	-0.3
Lower Ricardian offset: lowered from 0.5 to 0			
Federal and CPP/QPP	-2.1	-1.7	-1.8
of which:			
federal	-1.6	-1.4	-1.5
CPP/QPP	-0.6	-0.3	-0.3
Economy more open: CA parameter increased by 2 standard errors			
Federal and CPP/QPP	-2.1	-1.5	-1.5
of which:			
federal	-1.5	-1.2	-1.2
CPP/QPP	-0.6	-0.3	-0.3
Economy more closed: CA parameter decreased by 2 standard errors			
Federal and CPP/QPP	-2.1	-1.6	-1.7
of which:			
federal	-1.5	-1.3	-1.4
CPP/QPP	-0.6	-0.3	-0.3

Interest rate

For the base case calculations of the Canadian fiscal gap, the discount rate is assumed to be a constant 7 per cent. The nominal interest rate is used to calculate the present value of the projected primary balance and GDP, which enter the numerator and denominator (respectively) of the fiscal gap measure (recall equation (5)). As such, the relation between the interest rate and the fiscal gap is ambiguous. For the federal government, the change in the present value of the projected primary balance resulting from a change in the interest rate outweighs the change in the present value of projected GDP. Thus, an increase in the interest rate yields a smaller negative fiscal gap at the federal level (less fiscal room), and a decrease in the interest rate yields a larger negative fiscal gap (more fiscal room). The inverse is true for the CPP/QPP fiscal gap, although the change in the federal gap outweighs the change in the pension sector gap. Thus, using a discount rate of 9 per cent yields a combined federal-CPP/QPP fiscal gap through 2075 of -0.9 per cent of GDP, while a lower interest rate of 5 per cent yields a gap of -2.2 per cent. Either way, fiscal policy is shown to be sustainable.

Productivity growth

In the base case, total factor productivity (TFP) growth is assumed to be 0.9 per cent, consistent with steady-state labour productivity growth of 1.5 per cent. The sensitivity analysis examines two alternative scenarios: TFP growth of 1.5 per cent and of 0.3 per cent.

In the federal case, a change in TFP growth affects both the numerator (through the primary balance) and the denominator (through GDP). However, changes in TFP growth primarily affect only one component of the primary balance; they affect revenues, which are held constant as a share of GDP, but do not affect federal program spending to the same extent (since the enrichment factor for a significant share of program spending is held constant in our model). Thus, as TFP growth increases, revenues become more important relative to spending, leading to a larger negative fiscal gap (more fiscal room). Conversely, a decrease in TFP growth implies less fiscal room. For the CPP/QPP gap, changes in TFP growth affect only the denominator (through GDP). Thus, an increase in productivity growth reduces the CPP/QPP gap, whereas a decrease in productivity growth widens the gap. The change in the federal gap outweighs the change in the CPP/QPP gap. In total, higher TFP growth of 1.5 per cent yields a combined federal-CPP/QPP fiscal gap through 2075 of -3.0 per cent of GDP, whereas a lower TFP growth rate of 0.3 per cent yields a gap of -0.1 per cent.

As noted above, these sensitivity tests are based on the assumption that a significant share of federal program spending is not affected by changes in productivity growth, because the enrichment factor remains constant at 1.5 per cent. If in each scenario we adopted a different constant enrichment factor to reflect different TFP growth assumptions, it would simply dampen the results of the sensitivity analysis. For example, lower TFP growth would imply a smaller enrichment factor, which would in turn lower federal program spending growth. This would dampen the deterioration in the fiscal gap described above in the low TFP growth scenario. Similarly, higher TFP growth would lead to a higher

enrichment factor, which would raise federal program spending growth, dampening the improvement in the fiscal gap resulting from higher TFP growth.

Ricardian offset

Our base case estimates are based on the assumption that changes in private saving offset half of any change in government saving. A lower offset would amplify any change in government saving through its effect on the economy, whereas a higher offset would dampen the effect of changes in government saving on the economy. In the first case (amplifying effect – less Ricardian), higher economic growth raises federal revenues relative to program spending (because revenues are held constant as a share of GDP), yielding more fiscal room. The reverse is true in the case of the dampening effect (more Ricardian).

GAO's estimates are based on the assumption that nonfederal saving remains constant as a share of GDP. In other words, it is based on the assumption of zero Ricardian equivalence. We did not use the same assumption as GAO with regard to Ricardian equivalence because we deemed it to be unrealistic in the Canadian case. However, using the same assumption for the Canadian estimates yields a larger negative fiscal gap than in the base case (more fiscal room); the combined federal-CPP/QPP gap through 2075 then grows to -1.8 per cent of GDP. This result underscores the main result of the paper, that the Canadian fiscal position is much more favourable than that of the US over the longer term. Even when we assume full Ricardian equivalence (i.e., no feedback effect between government saving and the economy), current fiscal policy is shown to be sustainable. Indeed, the combined federal-CPP/QPP gap through 2075 is reduced only slightly in comparison to the base case, to -1.4 per cent of GDP.

Degree of openness of the economy

The base case scenario assumes that roughly two-thirds (63 per cent) of any change in gross domestic saving flows into the current account. This assumption is based on the estimated responsiveness of the current account to domestic saving over the last decade. A more closed economy would amplify any change in government saving, whereas a more open economy would dampen any such change. As in the case of the Ricardian offset parameter, an amplifying effect translates into greater fiscal room, and vice versa for a dampening effect. This is due to the fact that federal revenues are held constant as a share of GDP, whereas program spending is not affected by GDP to the same extent.

GAO's estimates are based on the assumption that one-third of any change in national saving flows abroad. Lowering our estimate of 63 per cent by two standard errors (to 40 per cent) does not affect the combined federal-CPP/QPP fiscal gap, although it yields a slightly larger federal gap through 2075 of -1.7 per cent of GDP. Raising the parameter by two standard errors (to 87 per cent) yields a federal-CPP/QPP gap of -1.5 per cent of GDP, indicating only slightly less fiscal room than in the base case. Thus, our qualitative results are not sensitive to changes in the assumption about the openness of the economy.

6.2.2 Sensitivity analysis of US fiscal gap estimates

In the absence of a standard sensitivity analysis of the US fiscal gap estimates, it is useful to compare GAO's estimates to those from other sources to put them into perspective. To that end, we refer to Auerbach et al.'s (2002) recent estimates of the US fiscal gap, which are considerably higher than those based on GAO's projections. Using what they judge to be the most plausible definition of current policy,[17] Auerbach et al. estimate that the fiscal gap through 2075 is as high as 7.1 per cent of GDP. This higher estimate lends support to our decision to use GAO's conservative estimate (scenario 2) as the US base case in this paper. Indeed, Auerbach et al.'s estimates suggest that the US fiscal gap could be much higher than indicated by GAO's estimate.

7. Conclusion

This paper begins by explaining that standard Canada-US fiscal comparisons are misleading because they do not take account of the very different treatment of public pension plans in the two countries. As an alternative to such comparisons, the paper presents a framework based on the "fiscal gap", which is the amount by which taxes must be increased or program spending decreased, expressed as a constant fraction of GDP, in order to ensure that the debt-to-GDP ratio will return to its current level by a given point in the future. In essence, the fiscal gap indicates whether current fiscal policy is sustainable.

Using this framework, the paper presents a comparison of fiscal prospects in Canada and the US over three time frames: through 2025, 2050 and 2075. We find a sharp contrast between the estimated Canadian and US fiscal gaps under all three time horizons; the fiscal gap estimates indicate that current federal fiscal policy in the US is unsustainable, whereas the finances of comparable sectors in Canada – the federal government and the CPP/QPP – are sustainable over the long term.

Specifically, the US estimate through 2075, based on projections made by the US General Accounting Office, indicates that the federal government has a positive fiscal gap of 4.1 per cent of GDP. In other words, the US federal government would need to raise taxes or cut program spending by an immediate and permanent 4.1 per cent of GDP in order to ensure that the debt ratio in 2075 returns to its current level. This is a significant imbalance, equivalent to more than five times the size of the tax cut package passed in the US in June 2001. By contrast, our fiscal gap estimate through 2075 for the comparable sectors in Canada is -1.6 per cent of GDP, indicating that current fiscal policy is sustainable over the long term. Even over a shorter time horizon, we find a major difference between the two countries. The estimated Canadian fiscal gap through 2025 is -2.1 per cent of GDP, whereas the US estimate indicates a slight imbalance.

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[17] As with GAO's scenario 3 estimate, Auerbach et al. assume that the June 2001 tax cuts are made permanent and that discretionary spending is constant as a share of GDP from 2002. In addition, they go even further by assuming that adjustments to the tax code are made in order to hold the proportion of taxpayers paying the alternative minimum tax constant, and by assuming that other temporary tax provisions scheduled to expire under current law are extended on a continual basis.

It is important to note that a negative fiscal gap does not provide an estimate of surpluses available for policy measures. All that it shows is the scale of measures that could be adopted while ensuring that the debt-to-GDP ratio in the final period equals the initial debt burden, which would imply running deficits. In addition, the fiscal gap analysis is not a forecast of future fiscal policy; its purpose is instead to determine whether *current* fiscal policy would be sustainable over the long term. In essence, the fiscal gap's "value added" in this paper is that it provides a framework for making cross-country comparisons of fiscal sustainability on a consistent basis. The important point to take from this paper is not the numerical value of the fiscal gap estimates, but rather the size of the Canadian fiscal gap estimate relative to that of the US.

On this basis, we find that current US federal fiscal policy is unsustainable, whereas the finances of comparable sectors in Canada are on a sustainable path. All told, we conclude that Canada's long-term fiscal position is more favourable than that of the US.

Appendix
The long-term projection framework

Following the framework used by GAO and originally developed at the Federal Reserve Bank of New York,[18] growth in GDP is determined by growth in the labour force, capital stock and total factor productivity. GDP then in turn influences federal and (consolidated) provincial revenues and some components of federal spending (e.g., Equalization payments).

Given projections for government savings (based on projections of the primary balance as described in sections 5.1 and 5.2[19]), total government sector saving combined with private saving forms gross domestic saving. In our base case scenario, we assume that changes in private saving offset half of any change in government saving.

Gross domestic saving then influences investment and the next period's capital stock. Investment is determined residually given assumptions about the current account. For instance, it is assumed that the current account balance (as share of GDP) will tend to zero in the long run, but year-to-year changes in domestic saving will cause it to move around this trend. The magnitude of the year-to-year fluctuations reflects movements in savings and the current account observed over the 1990s.

Most other key parameter values are based on the Department of Finance's forecasting model CEFM. For a description of earlier versions of CEFM, see Robidoux and Wong (1998) and Cao and Robidoux (1998). The following provides further detail on the long-term projection framework and the key parameter estimates in our base case scenario.

Accounting frameworks

The economic structure of the model conforms to the National Accounts. The core fiscal structure conforms to the Public Accounts. Following GAO, high-level add factors are used to translate Public Accounts budget balances into National Accounts government saving. The model is based on annual data.

Model structure

Growth in the labour force combines with growth in the capital stock (machinery and equipment *KMAE* and non-residential construction *KNRC*, both expressed in nominal terms), total factor productivity growth (b2=0.009) and inflation (b3=0.02) to determine

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[18] For example, see Harris and Steindel (1991).

[19] Consolidated provincial program spending on the categories health, education and social services is projected using the cell-based approach from 2001/02. Following the federal spending projections, aggregate growth (in nominal terms) in each category is consistent with increases in real per capita (age-adjusted) spending growth of 1.5% per year. Other direct program spending is assumed to remain constant as a share of GDP. Local government sector saving over the projection period is assumed to remain constant at its 2000 level.

nominal GDP, *NGDP*. Labour's share in production (b1) is 0.60 and the share of machinery and equipment (b4) is 0.517.

$$NGDP_t = [b_2 + b_1 \cdot L_t / L_{t-1} + (1-b_1) \cdot (b_4 \cdot KMAE_{t-1} / KMAE_{t-2} + (1-b_4) \cdot KNRC_{t-1} / KNRC_{t-2} - b_3)] \cdot (1+b_3) \cdot NGDP_{t-1}$$

Fiscal accounting

Net public debt for the federal and provincial/territorial governments (*NPDF* and *NPDP* respectively) and the combined CPP and QPP pension plans (*NDCQ*) evolves according to the following equations. Primary balances below are denoted as *PB* and suffixed by the respective sector. The (nominal) net effective interest rates for the federal and CPP/QPP sectors are assumed constant at 7.0%. A (nominal) net effective interest rate of 8.5% is assumed constant for the provincial/territorial government sector. These rates could be made to vary over time however they are held constant at the same rate for the purposes of calculating fiscal gaps following Auerbach (1994, 1997). The Public Accounts budget balance for these sectors can be expressed in terms of the change in the level of net public debt.

$$NPDF_t = (1+i^F) \cdot NPDF_{t-1} - PBF_t$$
$$NPDP_t = (1+i^P) \cdot NPDP_{t-1} - PBP_t$$
$$NDCQ_t = (1+i^{CQ}) \cdot NDCQ_{t-1} - PBCQ_t$$

Domestic saving

In order to translate Public Accounts (PA) budget balances into National Accounts (NA) saving, high-level add factors are used, following GAO. These add factors are expressed as shares of GDP and they are calculated using base-year data (i.e., PA 2000/01 and NA 2000). Non-government sector saving *SAVNG* and consumption cost allowances *SAVCCA* are assumed to remain at their 2000 levels as shares of GDP. Gross domestic saving *SAVD*, is the sum of government and non-government saving plus consumption cost allowances. The parameter b5 incorporates a Ricardian offset. In our base case scenario, we assume that half of any change in government saving is offset by changes in non-government saving (b5=0.5).

$$SAVD_t = (1-b_5) \cdot [SAVF_t + SAVP_t + SAVCQ_t + SAVL_t] + SAVNG_t + SAVCCA_t$$

The current account and investment

Following GAO, the current account *CACC* (as a share of GDP) is assumed to tend toward zero over the long run. This is accomplished by holding it constant at its nominal level in 2000, with changes in domestic saving causing the current account to move around this trend. It is assumed that the current account rises by about two-thirds

(b6=0.63)[20] of the increase in the domestic saving rate. By comparison, GAO assumes a response of one-third.

$$CACC_t = CACC_{2000} + b_6 \cdot \left[SAVD_t - \frac{SAVD_{2000}}{NGDP_{2000}} \cdot NGDP_t \right]$$

Gross domestic investment (*INVD*) is determined residually using the basic saving identity. Investment in machinery/equipment (*IMAE*) and non-residential construction (*INRC*) is determined based on their shares of total investment in 2000.

$$INVD_t = SAVD_t - CACC_t$$

Finally, the capital stock for machinery/equipment (*KMAE*) and non-residential construction (*KNRC*) evolves according to the equations below. The rate of depreciation for the stock of machinery and equipment is set at b7=0.12, and b8=0.03 for the stock of non-residential construction.

$$KMAE_t = (1 - b_7) \cdot KMAE_{t-1} + IMAE_t$$
$$KNRC_t = (1 - b_8) \cdot KNRC_{t-1} + INRC_t$$

[20] This parameter was calibrated based on a simple regression of the current account and net domestic saving (as shares of GDP) over the 1990s.

References

Auerbach, Alan J. (1994), "The U.S. Fiscal Problem: Where We Are, How We Got Here, and Where We're Going," in S. Fischer and J. Rotemberg (eds.), *NBER Macroeconomics Annual*, NBER, pp.141-75.

_____ (1997), "Quantifying the Current U.S. Fiscal Imbalance," *National Tax Journal*, 50, pp.387-398.

Auerbach, Alan J. and William G. Gale (2000), "Perspectives on the Budget Surplus," *National Tax Journal*, 53(3), pp.459-73.

_____ (2001), "Tax Cuts and the Budget," *Tax Notes*, 90, pp.1869-82.

Auerbach, Alan J., William G. Gale and Peter R. Orszag (2002), "The Budget Outlook and Options for Fiscal Policy," *Brookings Institution*.

Blanchard, O., J. Chouraqui, R.P. Hagemann, and N. Sartor (1990), "The Sustainability of Fiscal Policy: New Answers to an Old Question," *OECD Economic Studies No.15*, Autumn, pp. 7-36.

Cao, Jian-Guo and Benoît Robidoux (1998), "The Canadian Economic and Fiscal Model – 1996 Version: Part 3 – Empirical Specification and Statistical Assessment," *Department of Finance Working Paper No. 98-07*.

Harris, E.S. and C. Steindel (1991), "The Decline in U.S. Saving and its Implications for Economic Growth," *Federal Reserve Bank of New York Quarterly*, Winter 1991.

King, Phillip and Harriet Jackson (2000), "Public Finance Implications of Population Ageing," *Department of Finance Working Paper No. 2000-08*.

Matier, Chris, Lisa Wu and Harriet Jackson (2001), "Analysing Vertical Fiscal Imbalance in a Framework of Fiscal Sustainability," *Department of Finance Working Paper No. 2001-23*.

Office of the Chief Actuary (1998), *Canada Pension Plan Seventeenth Actuarial Report as at 31 December 1997*.

Robidoux, Benoît and Bing-Sun Wong (1998), "The Canadian Economic and Fiscal Model – 1996 Version: Part 1 – Model Structure," *Department of Finance Working Paper No. 98-05*.

US General Accounting Office (2002), *Budget Issues: Long-Term Fiscal Challenges*, GAO-02-467T